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STATEMENT

I, Makoto KONDO, of c/o NGB Corporation, ARK Mori Building 28F, 12-32, Akasaka 1-Chome, Minato-ku, Tokyo 107-6028 Japan, hereby state that I am conversant with both the English and Japanese languages and certify to best of my knowledge and belief that the attached is a true and correct English translation of the priority document of Japanese patent application JP2000-207336 filed on July 7, 2000.

Date: July 15, 2003

Makoto Kondo

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This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: July 7, 2000

Application Number: Patent Application No. 2000-207336

Applicant(s): KOITO MANUFACTURING CO., LTD

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June 6, 2001

Commissioner,
Japan Patent Office Kozo OIKAWA
Issuance No. 2001-3053025

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[DOCUMENT NAME] REQUEST FOR PATENT APPLICATION

[REFERENCE NUMBER] P-1818

[APPLICATION DATE] July 7, 2000

[ADDRESSEE] COMMISSIONER OF PATENT OFFICE, ESQ.

[TITLE OF THE INVENTION] INSULATING PLUG FOR DISCHARGE LAMP DEVICE AND DISCHARGE LAPM DEVICE

[NUMBER OF CLAIMS] 3

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[DEPOSIT ACCOUNT NUMBER] 009667

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[NAME OF ITEM] SPECIFICATION 1

[NAME OF ITEM] DRAWING 1

[NAME OF ITEM] ABSTRACT 1

[PROOF] NECESSARY

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[Designation of Document] Specification

[Title of the Invention]

INSULATING PLUG FOR DISCHARGE LAMP DEVICE AND DISCHARGE LAMP DEVICE

[Claims]

[Claim 1] An insulating plug for a discharge lamp device comprising an arc tube, fixedly held at a front end portion thereof, and a lamp-side connector provided at a rear end portion thereof, a power-supplying connector being adapted to be attached to and detached from said lamp-side connector;

characterized in that a body of said insulating plug is made of a glass fiber reinforced plastic.

[Claim 2] An insulating plug for a discharge lamp device wherein said glass fiber reinforced plastic includes 20 weight % to 80 weight % glass fibers contained in a polyphenylene sulfide resin (PPS resin).

[Claim 3] A discharge lamp device provided with an insulating plug for a discharge lamp device as defined in claim 1 or claim 2.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

This invention relates to an improved technology of an insulating plug for a discharge lamp device, including a synthetic resin-made insulating plug body having an arc tube

fixedly held at a front end portion thereof, wherein a lamp-side connector, relative to which a power-supplying connector can be attached and detached, is provided integrally at a rear end portion of the synthetic resin-made insulating plug body.

[0002]

[Prior Art]

In recent years, "a discharge lamp (discharge bulb) device" of a construction, in which light is emitted by a discharge phenomenon developing between opposed electrodes in a glass bulb having xenon gas sealed therein, has been extensively used in vehicle lamps such as an automotive headlamp.

[0003]

The structure of this discharge lamp device will be briefly described.

This comprises a synthetic resin-made insulating plug body (hereinafter referred to as "insulating plug body"), obtained by injection molding it into a predetermined shape, using various synthetic resins, and an arc tube fixedly held at a front end portion of this insulating plug body. A lamp-side connector, relative to which a power-supplying connector can be attached and detached, is provided integrally at a rear end portion of the insulating plug body.

[0004]

The arc tube, provided at the front end portion of the insulating plug body, has a light emitting portion disposed

in a sealed space (sealed chamber) obtained by pinch sealing opposite ends of an elongate glass tube at a predetermined interval. Opposed discharge electrodes, made of tungsten, are disposed in this light emitting portion, and starter rare gas, mercury and a metal halide are sealed in the light emitting portion.

[0005]

Mainly for the purpose of cutting a ultraviolet component of a wavelength range which is contained in light, emitted from this light emitting portion, and is harmful to a human body, there is provided a shroud glass tube of a generally cylindrical shape which seals the arc tube in enclosing relation thereto, and forms the above sealed space. This shroud glass tube is supported by a lead support which is fixedly secured to the insulating plug body, and projects forwardly.

[0006]

In the discharge lamp device of this construction, the insulating plug body, forming a base portion, is provided in the vicinity of the arc tube, provided with the light emitting portion, and therefore is exposed to a high-temperature condition of 220°C, and a high voltage of about 20 kV is applied to this insulating plug body at the time of starting the lighting.

[0007]

The insulating plug body portion is the portion which is inserted in a lamp body, and also is the portion on which

the lamp-side connector, relative to which the power-supplying connector can be attached and detached, is mounted, and therefore a load is applied to this plug body at the time of the inserting and detaching (attaching and detaching) operations, and besides a high dimensional accuracy is required for it.

[0008]

[Problems that the Invention is to Solve]

However, although the insulating plug body of the conventional discharge lamp device has been required to have high durability, rigidity and moldability, a single synthetic resin material has been used, and therefore the insulating plug body has been insufficient in heat resistance, lifetime durability, connector fitting strength (rigidity), moldability (dimensional accuracy) and so on.

[0009]

Therefore, a technical problem has been directed toward providing an insulating plug body having all of these quality conditions. And besides, it has been increasingly desired that the cost of the discharge lamp devices, which are more expensive as compared with halogen lamps and the like, should be reduced.

[0010]

It is therefore an object of this invention to enhance the quality and performance, required for a plug body forming a base portion of a discharge lamp device, and also to reduce its cost.

[0011]

[Means for Solving the Problems]

In order to achieve the above object, the present invention basically provides an insulating plug for a discharge lamp device wherein a lamp-side connector, relative to which a power-supplying connector can be attached and detached, is provided at a rear end portion of an insulating plug body having an arc tube fixedly held thereon, and the insulating plug body is made of a glass fiber reinforced plastic.

[0012]

Therefore, the heat resistance, lifetime durability and connector fitting strength (rigidity) of the insulating plug body portion, which has heretofore been made of a single synthetic resin, are enhanced, and besides the cost reduction is achieved.

[0013]

By adopting the polyphenylene sulfide resin (hereinafter referred to as "PPS resin") as the base synthetic resin of the glass fiber reinforced plastics material to be used, the moldability and the recycling ability can be enhanced.

[0014]

By limiting the content of the glass fibers in the PPS resin to the range of between 20 weight % and 80 weight %, the durability, required for the insulating plug body, is secured, and besides a weld crack and the lowering of moldability

(dimensional accuracy), which would be caused by the excess content of the glass fibers, are prevented. The weld crack means a crack which develops at a boundary portion (weld) portion, facing a gate position, when the resin, injected and filled from a predetermined position during the injection molding of the cylindrical insulating plug body, having a central bore, surrounds the central bore portion.

[0015]

Therefore, in the insulating plug of the present invention for the discharge lamp device, the overall durability of the insulating plug body portion, which has heretofore had the problems, is improved, and therefore there is also provided a technical significance that the discharge lamp device, provided with this insulating plug for the discharge lamp device, is enhanced in durability.

[0016]

[Mode for Carrying Out the Invention]

An embodiment of the present invention will now be described with reference to the accompanying drawings.

Figs. 1 3 show the embodiment of this invention, and Fig. 1 is a perspective view of a discharge lamp device employing an insulating plug of this invention, Fig. 2 is a side-elevational view of the discharge lamp device, and Fig. 3 is an exploded, perspective view of arc tube perpendicularly-holding member.

[0017]

[Overall Construction of Discharge Lamp Device]

The overall construction of the discharge lamp 1 of this invention will first be described with reference to Figs. 1 to 3. In these Figures, reference numeral 1 denotes the discharge lamp device (whole), reference numeral 2 denotes the insulating plug (hereinafter referred to as "plug"), and reference numeral 3 denotes an arc tube.

[0018]

The arc tube 3 is fixedly supported on a front end portion X of the plug 2 by a metal lead support 4, which extends forwardly from the plug 2, and is protected by an insulating sleeve 41, and a metal support member 5 fixedly secured to a front surface of the plug 2. The discharge lamp device 1 is formed by these constructions.

[0019]

Specifically, an inner cylindrical portion 26, which has a base plate 53 provided at a front surface thereof, and is open, and an outer cylindrical portion 25, which has a focusing ring 24 mounted on a periphery thereof, and is open forwardly in surrounding relation to the inner cylindrical portion 26, are formed at the front end portion X (see Fig. 3) of the insulating plug 2.

[0020]

A lead wire 39b, extending from the front end portion

X of the arc tube 3, is fixedly secured by spot welding to a bent distal end portion 4a of the lead support 4. A rear end portion of the arc tube 3 is grasped by the metal-made perpendicularly-holding member 5 (a slide plate 51 and an arc tube-grasping band 52) fixedly welded to the base plate 53 provided at the front surface portion of the inner cylindrical portion 31.

[0021]

In the arc tube 3, a cylindrical shroud glass (ultraviolet ray shielding globe) 32 is fused (sealingly connected) integrally to an arc tube body 31 having a sealed glass bulb (light emitting portion) 33 containing opposed electrodes 37a and 37b. Namely, in this structure, the shroud glass 32 encloses the sealed glass bulb 33 in a sealed manner. Reference numeral 34 denotes a discharge axis extending between the electrodes 37a and 37b.

[0022]

The shroud glass 32 is made of silica glass which is doped with TiO_2 and CeO_2, and has an ultraviolet ray-shielding effect, and this shroud glass positively cuts ultraviolet rays of a predetermined range, harmful to a human body, from light emitted from the sealed glass bulb 33 serving as a discharge portion. The interior of the shroud glass 32 is kept to a vacuum, or inert gas is sealed in this shroud glass, and is so designed as to perform a heat insulating effect against the radiation

of heat from the sealed glass bulb 33 serving as the discharge portion.

[0023]

The arc tube body 31 is processed from a pipe-shaped silica glass tube, and has such a structure that the sealed glass bulb 33 in the form of an ellipsoid of revolution is formed at a predetermined position in its longitudinal direction, and is interposed between pinch seal portions 38a and 38b having a rectangular transverse cross-section. Starter rare gas, mercury and a metal halide (for example, sodium-scandium light emitting substance) are sealed in the sealed glass bulb 33.

[0024]

Rectangular plate-like molybdenum foils 36a and 36b are sealed in the pinch seal portions 38a and 38b, respectively. Within the sealed glass bulb 33, the opposed tungsten electrodes 37a and 37b are disposed between the molybdenum foils 36a and 36b, and lead wires 39a and 39b, extended to the exterior of the arc tube body 31, are connected respectively to outer portions of the molybdenum foils 36a and 36b. The construction of the plug 2 will be described below.

[0025]

[Structure of Plug (Insulating Plug)]

The focusing ring 24, which forms an abutment reference surface f_1 (see Fig. 2), and is engaged in a bulb insertion hole 61 (see Fig. 2) in a reflector 6 of an automotive headlamp

(not shown), is formed on the outer periphery of the front end portion X.

[0026]

A lamp-side connector C_2, relative to which a power-supplying connector C_1 (see Fig. 2), containing a terminal of a power-supplying cord 7 electrically connected to a power source (not shown), can be attached and detached, is formed integrally at a rear end portion Y of the plug 2.

[0027]

Therefore, the plug 2 is the portion for engagement in the bulb insertion hole 61, and also is the portion relative to which the lamp-side connector C_2 can be attached and detached, and therefore this plug is required to have a high dimensional accuracy, and also is required to have rigidity (strength).

[0028]

An opening 29, in which a rear extension portion 3a (see Fig. 3) of the arc tube 3 can be inserted and received, is formed in the inner cylindrical portion 26 at the front end portion of the plug 2, and the outer cylindrical portion 24, having the flange-like focusing ring 24 formed on the outer periphery thereof, is formed around the inner cylindrical portion 26. The metal base plate 53, forming a reference flat surface, is held in intimate contact with and fixedly secured to a cylindrical front end of the inner cylindrical portion 26.

[0029]

A front surface of the base plate 53, integrally connected to the plug 2, forms a reference flat surface f_2 (see Fig. 2) disposed parallel to the reference flat surface f_1 (see Fig. 2) of the focusing ring 24 serving as a reference member for the positioning relative to the reflector 100.

[0030]

The metal slide plate 51 and the metal arc tube-grasping band 52 are mounted on this base plate 53. The slide plate 51 and the grasping band 52 serve as the metal-made perpendicularly-holding member 5 for perpendicularly holding the shroud glass 32 of the arc tube 3. The discharge axis 34 of the arc tube 3 is disposed at a predetermined position on an extension line of a central axis 27 (see Fig. 2) of the focusing ring 24.

[0031]

Namely, in the grasping band 52 forming the perpendicularly-holding member 5, ear pieces 52b of a rectangular shape, bent in a cross-sectionally L-shape, are formed respectively at opposite ends of a curved, band-like band body 52a which are to be mated together, as shown in Fig. 3. The ear pieces 52b of the band body 52a, wound around the shroud glass 32, are mated with each other, and are spot welded together, thereby fixing the grasping band 52 around the shroud glass 32.

[0032]

Reference numeral 52c denotes bent portions which are formed at two portions of the band body 52a in the longitudinal direction thereof. The resilient deformation of these bent portions 52c causes the band body 52a to expand and contract in the longitudinal direction. Therefore, the band body 52a can be wound around and fixed to the shroud glass 32. Reference numeral 52d denotes a spot welded portion.

[0033]

A base surface 51a of the metal slide plate 51, forming the perpendicularly-holding member 60, is formed into a doughnut disk-like shape so as to be mated with a base surface 53a of the base plate 53. Four leaf spring-like, tongue-like gripping pieces 51b are formed by stamping on an inner peripheral edge of the metal slide plate 51 in an upstanding manner, and are disposed at equal intervals in the circumferential direction.

[0034]

The outer periphery of the grasping band 52, fixedly wound around the shroud glass 32, is gripped by these tongue-like gripping pieces 51b, and the tongue-like gripping pieces 51b are laser welded to the grasping band 52. As a result, the arc tube 3 is integrally connected to the slide plate 51 in such a manner that the discharge axis 34 of the arc tube 3 is disposed perpendicular to a joint surface f_3 of the slide plate 51, joined to the base plate 53, and is spaced a predetermined distance from the joint surface f_3. Reference numeral 51c

denotes laser welded portions.

[0035]

The round pipe-shaped insulating sleeve 41 of ceramics, through which the lead support 41 is passed, is inserted in a sleeve insertion hole 28 which is open to the front surface of the plug 2. An insertion end portion of the lead support 41, extending through the insulating sleeve 41, is laser welded to a predetermined portion of a bottom (not shown) of the sleeve insertion hole 28.

[0036]

[Material Composition of Plug (Insulating Plug)]

As described above, the arrangement of the plug 2, the arc tube 3 and so on should be determined delicately and subtly, and therefore during the molding of the plug 2, the precision of its configuration is important. At the same time, the configuration of the plug 2 is complicated as described above, and therefore the easy molding is required.

[0037]

And besides, the power-supplying connector C_1 is attached to and detached from the rear end portion Y of the plug 2, and this plug is the member for being engaged in the bulb insertion hole 61 (see Fig. 2) in the reflector 6 of the automotive headlamp, and therefore the plug is required to have high rigidity.

[0038]

Furthermore, in the discharge lamp device 1 of the above

construction, the plug 2, forming the base portion, is provided in the vicinity of the arc tube 3 having the sealed glass bulb 33 serving as the light emitting portion, and therefore this plug is exposed to a high-temperature condition of about 220°C because of a heat-generating effect of the light emitting portion. And, a high voltage of about 20 kV is applied at the time of starting the lighting. Therefore, high heat resistance and voltage-withstanding properties are required for the plug 2. And besides, even when the plug is used for a long period of time, deformation, cracking, dielectric breakdown and so on should not develop in the plug.

[0039]

Therefore, in the molding (injection molding) of the plug 2 of the present invention, the inventors of the present invention have considered the complicated shape of the plug 2, and have first decided to adopt a PPS resin as a synthetic resin, serving as a base material, on the basis of the idea that its moldability need to be enhanced.

[0040]

From the viewpoint of enhancing the heat resistance and voltage-withstanding properties, the inventors have conceived the idea of adding a predetermined amount of glass fibers to the PPS resin. Namely, the inventors have obtained the idea that the glass fiber reinforced plastics material, containing the PPS resin as the base material, is suitable as the material

for the plug 2.

[0041]

However, it has been found through various studies that the material composition must be arranged in further detail in order to obtain the plug 2 which can be evaluated as having the acceptable quality with respect to all of (1) heat resistance, (2) lifetime durability, (3) connector fitting strength (rigidity) and (4) dimensional accuracy (moldability).

[0042]

Therefore, changing the ratio (weight %) of glass fibers in a PPS resin, the inventors of the present invention conducted detailed tests 1 to 4 for ascertaining the above Items (1) to (4). Description will be made below with reference to Figs. 4 to 8 showing results of these test.

[0043]

(1) Test for Heat Resistance (Test 1)

With respect to plugs 2, having their respective glass fiber ratios (weight %, referred to as "GF" in Fig. 4) of 5, 10, 15, 20, 30, 40, 50, 60, 70, 80 and 90% in the PPS resin, there were prepared ten plugs 2 for each glass fiber ratio, and the heat resistance test was conducted.

[0044]

As a result, as shown in a graph of Fig. 4, with the GF of not smaller than 20%, any appearance abnormality (cracking, melting, deformation, looseness and welding breakage) was not

observed at all, and it was found that the heat resistance of not smaller than 220°C could be secured.

Incidentally, with respect to the glass fiber ratio of 5%, 10% and 15%, the deformation-developing number was 8/10 in the case of the glass fiber ratio of 5%, it was 5/10 in the case of the ratio of 10%, and it was 3/10 in the case of the ratio of 15%. Test 1 was conducted under conditions including an atmosphere temperature of 85°C and a continuous lighting time of 500 hours.

[0045]

(2) Test for Lifetime Durability (Test 2)

Using the same GF ratios in the PPS resin as the glass fiber ratios described in the above Test 1, the lifetime durability test was conducted by a method of confirming whether or not cracking develops as a result of continuous lighting. Generally, the lifetime durability, required for the discharge device 1, should be such that deformation and so on will not occur even when the continuous lighting time exceeds 3000 hours.

[0046]

As shown in a graph of Fig. 5, it was found that when the GF ratio was in the range of between more than 20% and less than 80%, deformation and so on did not occur even when the continuous lighting time exceeded 5000 hours. And, it was found that when the GF ratio was in the range of between 40% and 60%, deformation and so on did not occur even when the continuous

lighting time exceeded 5000 hours.

[0047]

With respect to the glass fiber ratio of 5%, 10% and 15%, the actual lighting time was 1786 hours in the case of the glass fiber ratio of 5%, it was 2485 hours in the case of the ratio of 10%, it was 2733 hours in the case of the ratio of 15%, and it was 2174 hours in the case of the ratio of 90%, and in each of these cases, cracks were produced from voids.

[0048]

(3) Test for Connector Fitting Strength (Rigidity) (Test 3)

Using the same GF ratios in the PPS resin as the glass fiber ratios described in the above Test 1, the test for the connector fitting strength (rigidity) was conducted. Specifically, the plug 2 and the power-supply connector C_1 were fitted together, and there was measured a value of a torque wrench obtained when the plug 2 and the connector C_1 were broken, so that a load was released. An acceptable level was set to not smaller than 3.0 N·m, and evaluation was effected.

[0049]

As a result of this test 3, as shown in a graph of Fig. 6, it was found that when the GF was in the range of not smaller than 15%, the torque wrench value of not smaller than 3.0 N·m could be positively secured. It was found that when the GF was in the range of between 40% and 80%, the torque wrench value

was particularly stable at around 4.5 N·m.

[0050]

(4) Test for Dimensional Accuracy (Moldability) (Test 4)

Using the same GF ratios in the PPS resin as the glass fiber ratios described in the above Test 1, the test for dimensional accuracy (moldability) was conducted. Generally, the dimensional accuracy (moldability) of a product can be accurately judged by process capability (CPK). Here, "process capability" indicates the degree of quality which is achieved when the process is standardized, and causes for abnormality are removed, and the process is kept in a stable condition.

[0051]

Therefore, in this Test 4, dimensions of various portions of the plugs 2 were measured using a micrometer and calipers, and dimensional errors of the plugs 2 for each GF ratio were measured, and data were gathered. A histogram was prepared using these data, and a process capability index was calculated from a predetermined calculation formula. The number of samples, used in this Test 4, is 30 for each GF ratio.

[0052]

As shown in Fig. 7, it was found that when the GF ratio went below 20%, the process capability index became less than 1. Therefore, with respect to the dimensional accuracy (moldability) of the plug 2, the GF ratio of not smaller than

20% is desired. Also, it was found that the process capability became stable at around 1.7 from the GF ratio of 40%, so that the dimensional accuracy became particularly stable.

[0053]

As shown in Fig. 8 which is an illustration (diagram) collectively showing the results of the above Tests 1 to 4, when the content of the glass fibers in the PPS resin was limited to the range of between 20 weight % and 80 weight %, all of the heat resistance, lifetime durability, connector fitting strength (rigidity) and dimensional accuracy, required for the insulating plug body, were all good. In Fig. 8, "O" indicates "very good", "Δ" indicates "substantially good", and "X" indicates "not good".

[0054]

[Advantageous Effects of the Invention]

In the present invention, by forming the insulating plug body from the glass fiber reinforced plastic, the heat resistance, lifetime durability and connector fitting strength (rigidity) of the insulating plug body portion, which has heretofore been made of a single synthetic resin, can be enhanced, and besides the cost reduction can be achieved.

[0055]

By adopting a polyphenylene sulfide resin (hereinafter referred to as "PPS resin") as the base synthetic resin of the glass fiber reinforced plastics material to be used, the

moldability and so on can be enhanced. And, by limiting the content of the glass fibers in the PPS resin to the predetermined range which is clearly critically significant, the overall durability, required for the insulating plug body, can be secured, and besides the lowering of the welding strength and moldability (dimensional accuracy), which would be caused by the excess content of the glass fibers, can be prevented.

[0056]

Thus, in the insulating plug of the present invention for the discharge lamp device, the overall durability of the insulating plug body portion, which has heretofore had the problems, is improved, and besides the cost reduction can be achieved, and therefore the discharge lamp device, provided with this insulating plug for the discharge lamp device, can be enhanced in durability, and its cost reduction can be achieved. This can contribute to the wide use of discharge lamp devices.

[Brief Description of the Drawings]

[Fig. 1]

A perspective view of a discharge lamp device (1) adopting an insulating plug (2) of the present invention.

[Fig. 2]

A side-elevational view of the discharge lamp device (1).

[Fig. 3]

An exploded, perspective view of an arc tube perpendicularly-holding member (5).

[Fig. 4]

A diagram (graph) showing results of test (Test 1) for heat resistance.

[Fig. 5]

A diagram (graph) showing results of test (Test 2) for lifetime durability.

[Fig. 6]

A diagram (graph) showing results of test (Test 3) for connector fitting strength (rigidity).

[Fig. 7]

A diagram (graph) showing results of test (Test 4) for dimensional accuracy (moldability).

[Fig. 8]

A diagram (illustration) collectively showing the results of Tests 1 to 4.

[Description of the Reference Numerals and Characters]

1 discharge lamp device

2 insulating plug body

3 arc tube

C_1 lamp-side connector

C_2 lamp-side connector

X front end portion (of the plug (2))

Y rear end portion (of the plug (2))

[Designation of Document] Abstract

[Abstract]

[Problem] To enhance the quality and performance, required for a plug body forming a base portion of a discharge lamp device, and also to reduce its cost.

[Means for Resolution] In an insulating plug 2 for a discharge lamp device 1, a lamp-side connector C2, relative to which a power-supplying connector C1 can be attached and detached, is provided at a rear end portion Y of the resin-made insulating plug body 2 having an arc tube 3 fixedly held thereon, and by adopting a glass fiber reinforced plastic for the insulating plug body 2, the durability, molding precision and so on of the plug 2 and hence those of the discharge lamp device 1, provided with this plug 2, are enhanced.

[Selected Figure] Fig. 1

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FIG. 1

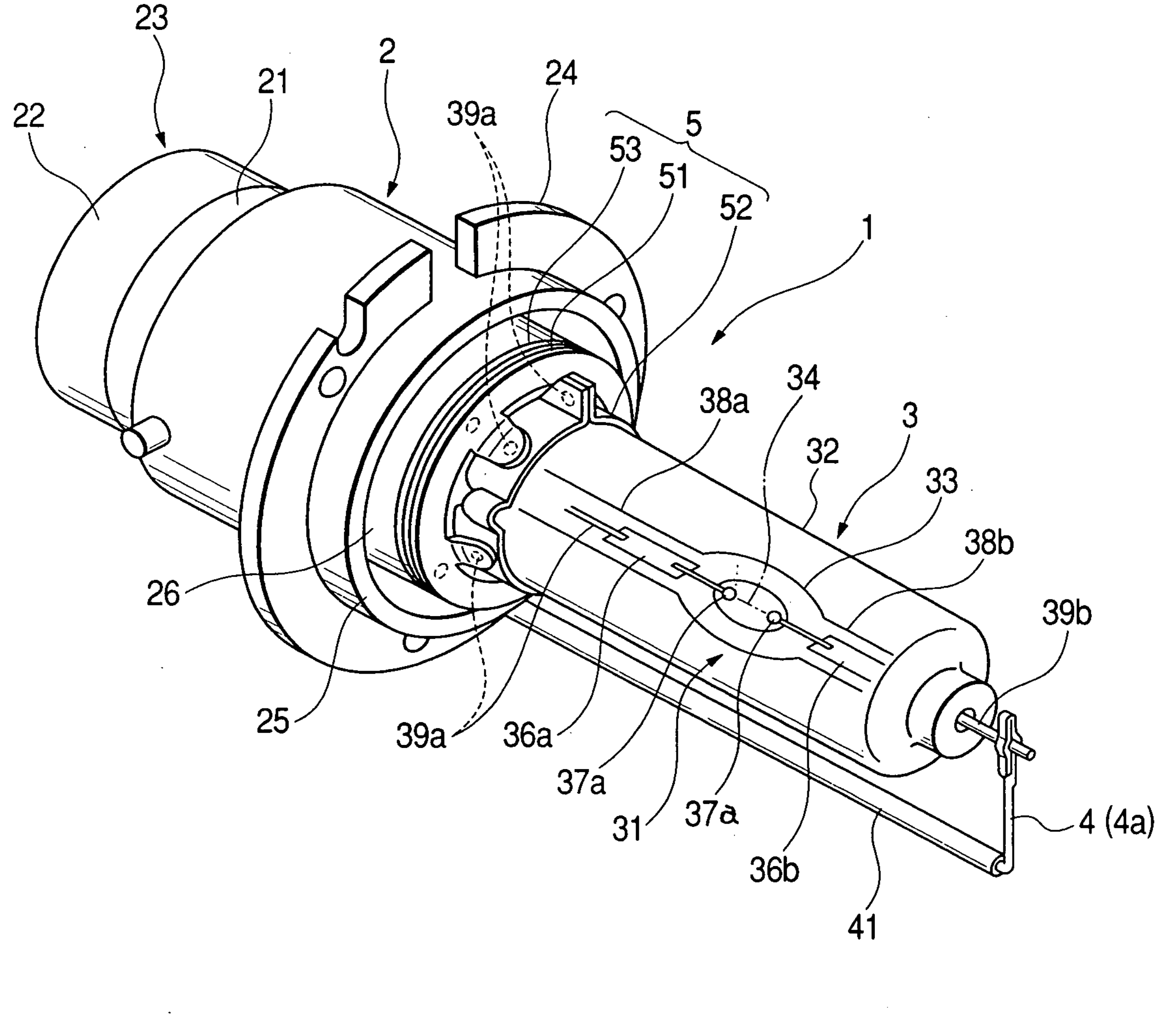

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FIG. 2

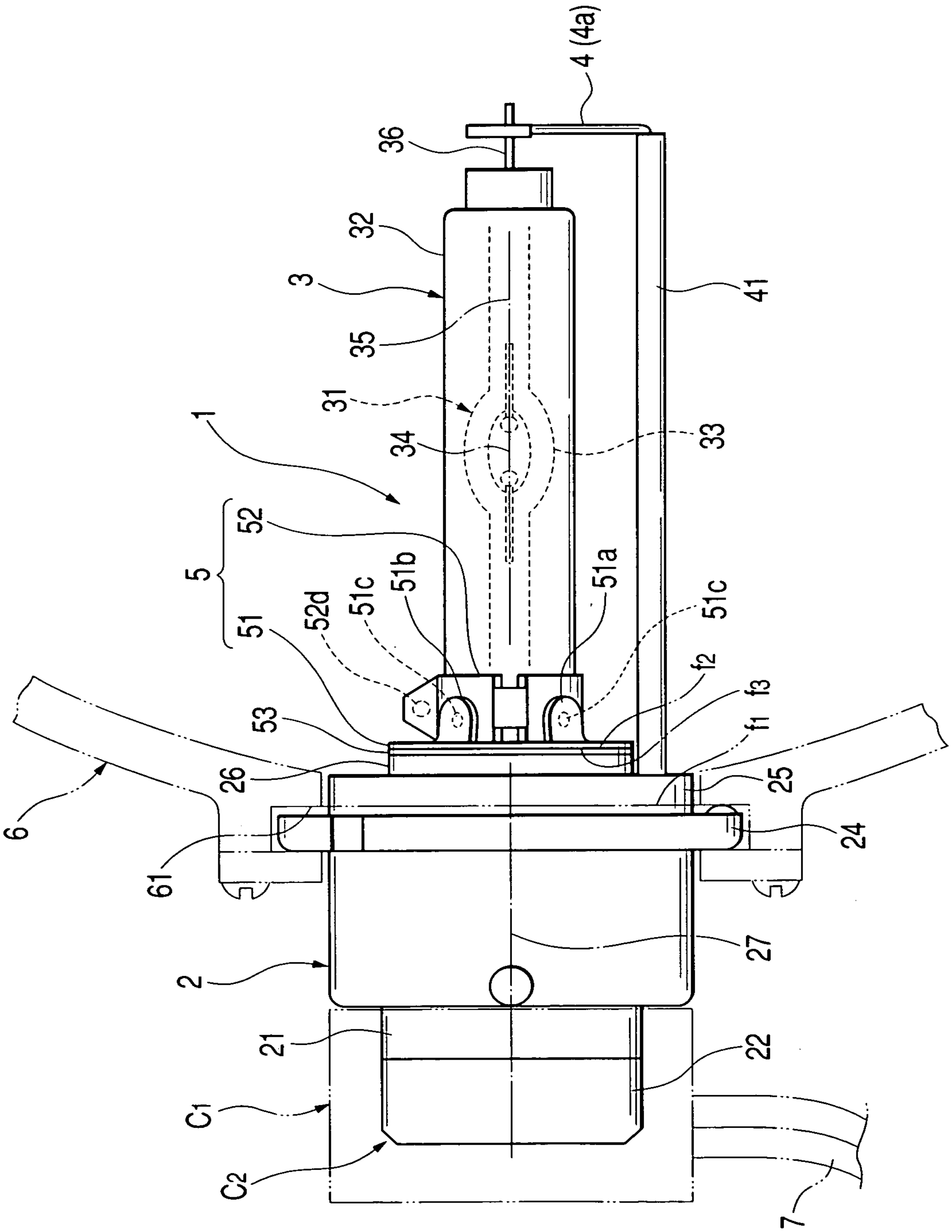

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FIG. 3

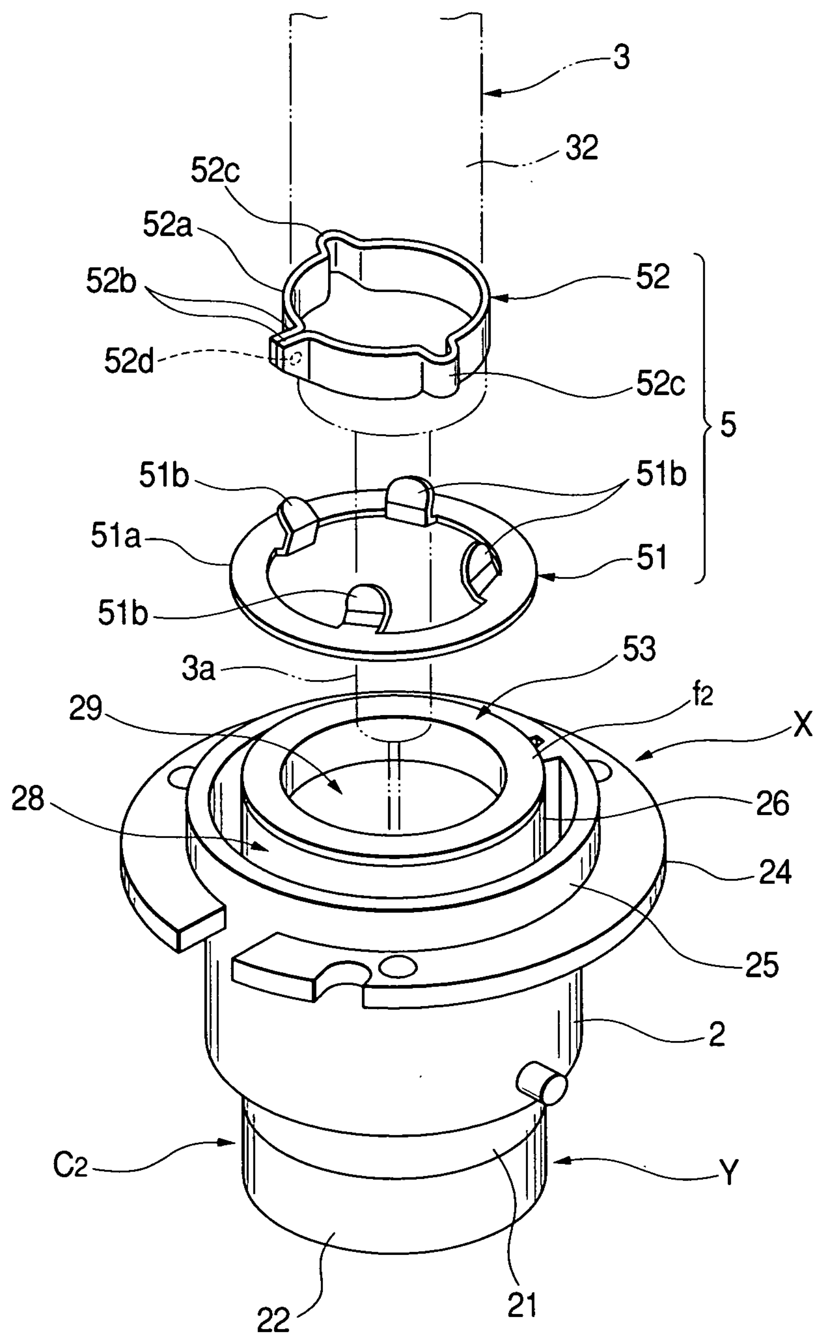

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FIG. 4

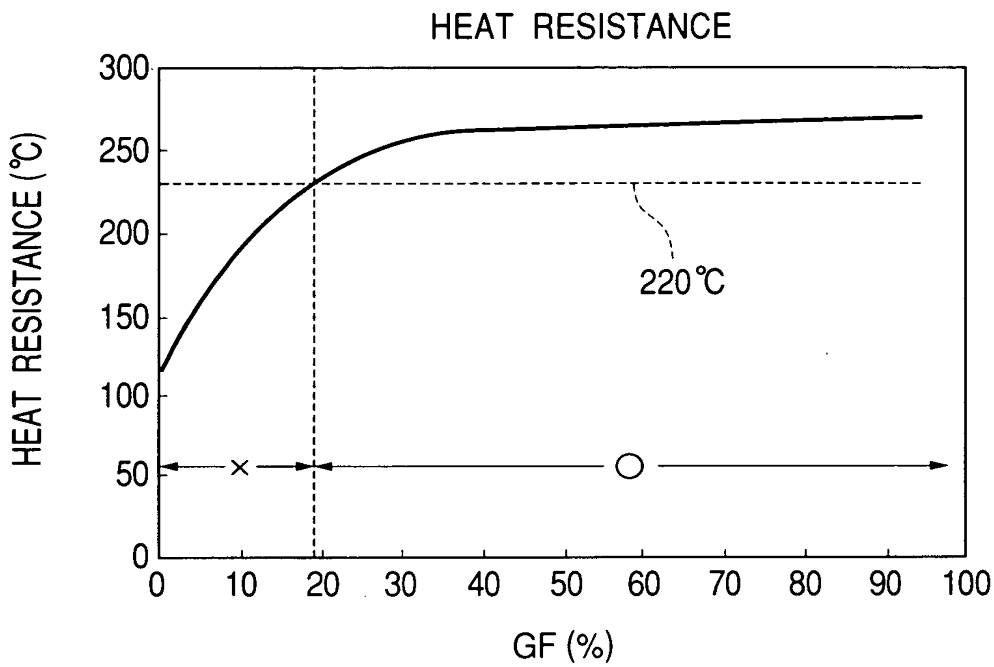

FIG. 5

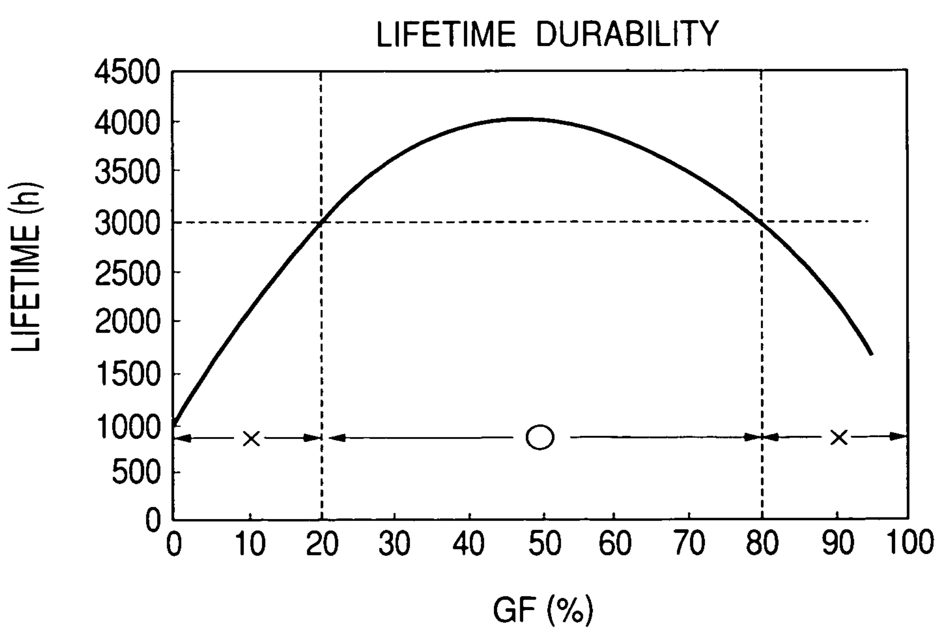

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FIG. 6

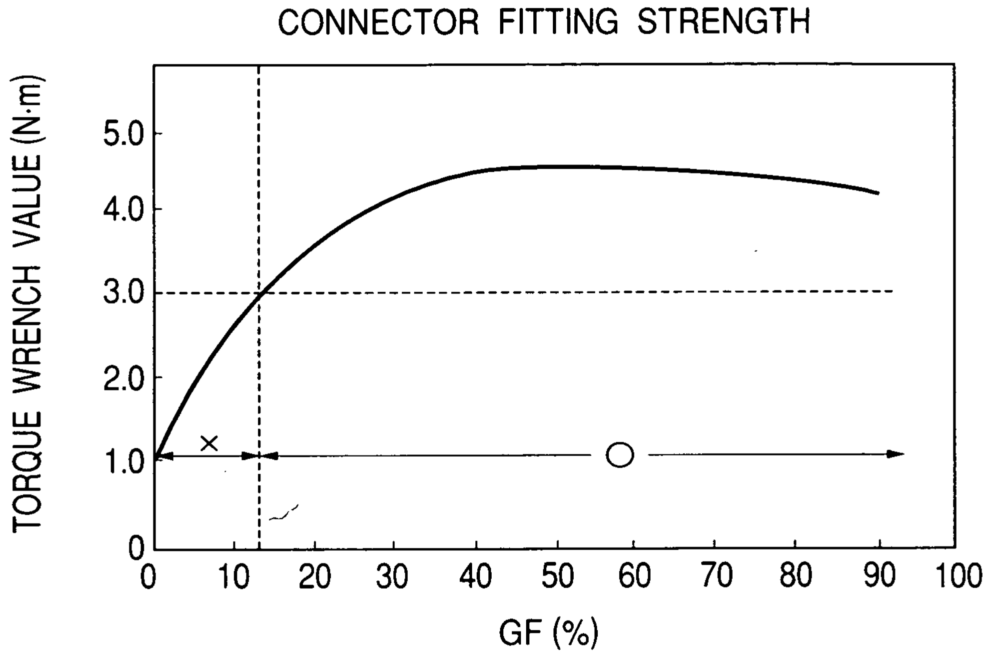

FIG. 7

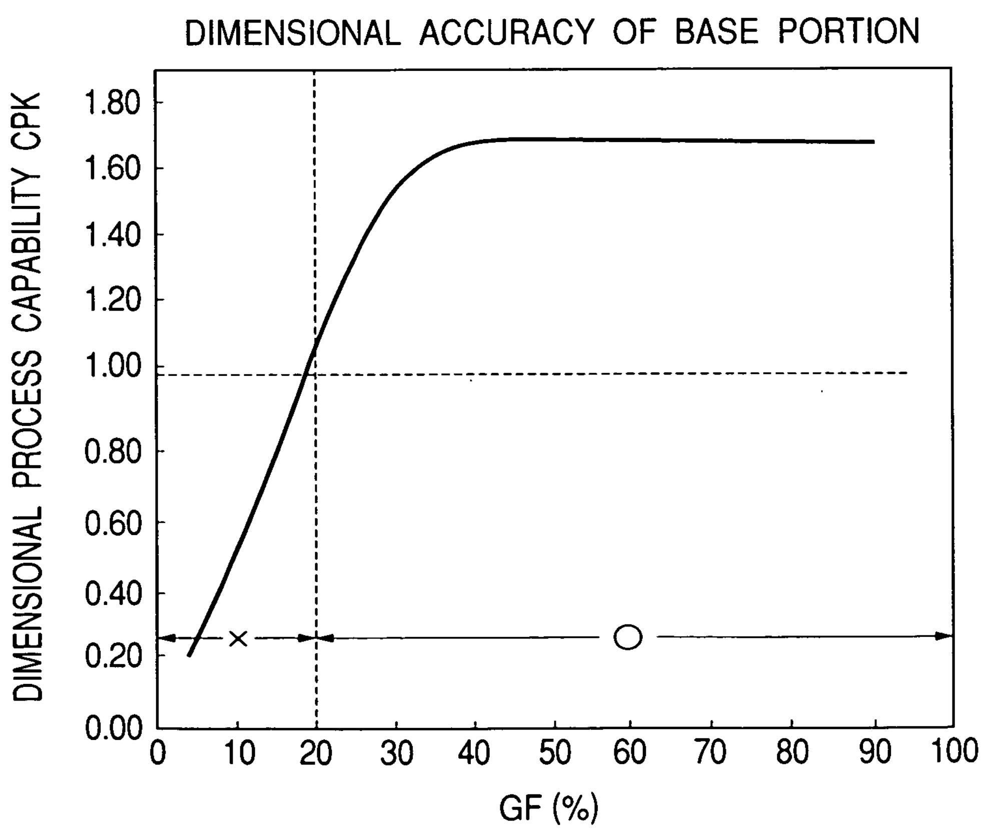

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FIG. 8

GLASS FIBER RATIO (%)	5	10	15	20	30	40	50	60	70	80	90
HEAT RESISTANCE	DEFORMATION DEVELOPED ×	DEFORMATION DEVELOPED ×	DEFORMATION DEVELOPED ×	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○	NO ABNORMALITY ○
LIFETIME DURABILITY LIGHTING TIME: 3000h≦	1786 (VOID CRACK) ×	2485 (VOID CRACK) ×	2733 (VOID CRACK) ×	3350 ○	4680 ○	5000≦ ○	5000≦ ○	5000≦ ○	4680 ○	3350 ○	2174 (WELD CRACK) ×
CONNECTOR FITTING STRENGTH TEST 3.0(N·m)≦	1.9 ×	2.6 ×	3.2 ○	3.5 ○	4.2 ○	4.4 ○	4.5 ○	4.5 ○	4.4 ○	4.4 ○	4.2 ○
PLUG DIMENSIONAL ACCURACY PROCESS CAPABILITY:1.0≦	0.22 (LARGE SHRINKAGE) ×	0.43 (LARGE SHRINKAGE) ×	0.89 (LARGE SHRINKAGE) ×	1.08 ○	1.55 ○	1.70 ○	1.72 ○	1.71 ○	1.68 ○	1.70 ○	1.71 ○